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ARIZONA CORPORATION
COMMISSION

Docket #: E-00000XX-13-0214

Memo

RECEIVED
2014 MAR 18 P 3:05
AZ CORP COMMISSION
DOCKET CONTROL

To: Arizona Corporation Commission, Docket Control
From: Office of Commissioner Gary Pierce
CC:
Date: Tuesday, March 18, 2014
Re: Energy Efficiency & Integrated Resource Planning

ORIGINAL

On Tuesday March 18, 2014 Commissioner Gary Pierce chaired a workshop on Energy Efficiency & Integrated Resource Planning. One of the companies that presented at the workshop distributed a PowerPoint that our office will be docketing to both of the Energy Efficiency dockets.

Arizona Corporation Commission

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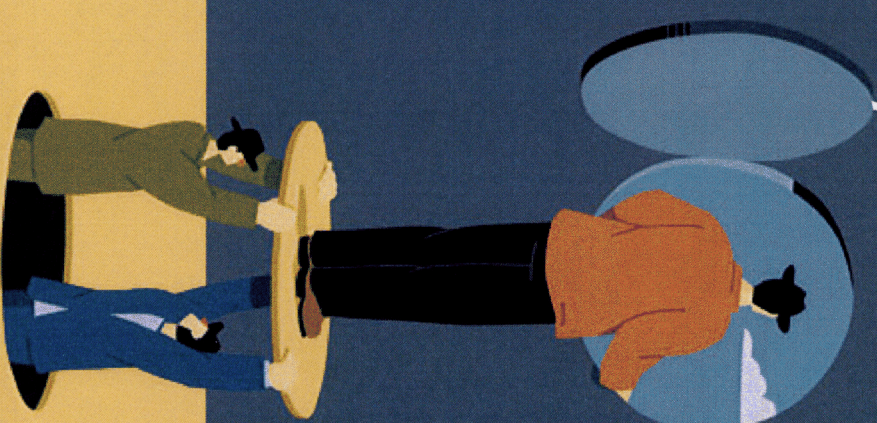
ENERGY

Energy-Efficiency Cost-Effectiveness Screening: An overview of tests, key inputs, and practices from across the country

Arizona Corporation Commission Cost-Effectiveness
Workshop

Phoenix, Arizona

March 18, 2014

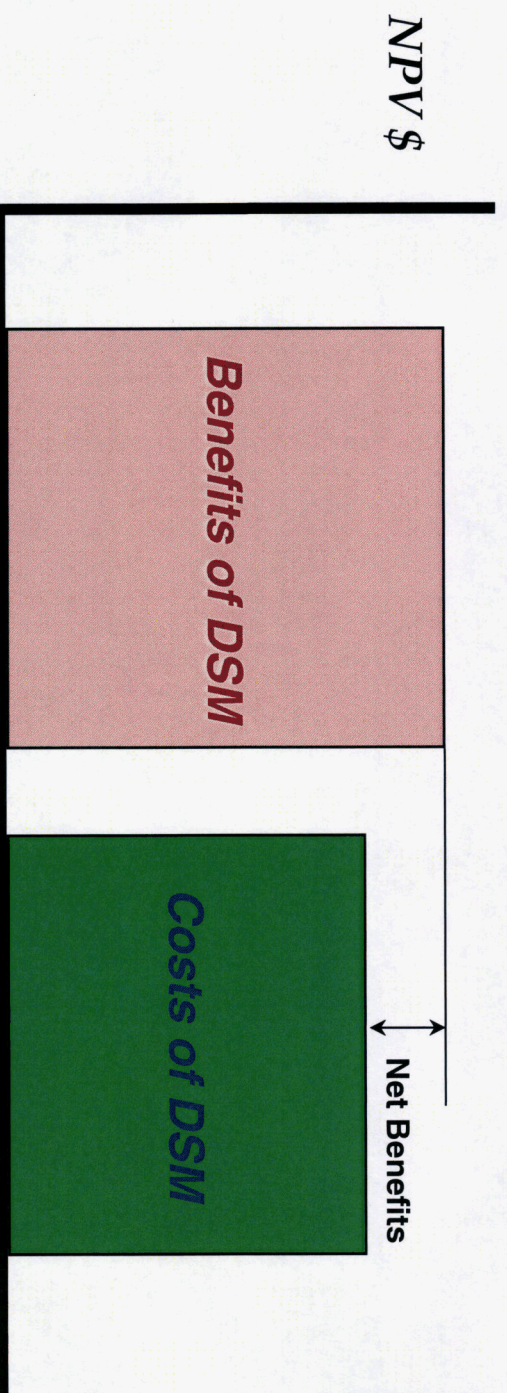


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DISPUTES & INVESTIGATIONS • ECONOMICS • FINANCIAL ADVISORY • MANAGEMENT CONSULTING

Overview of Cost-Effectiveness Analysis

- » Role of cost-effectiveness tests
 - » Results drive the type of energy-efficiency (EE) resources acquired.
 - » Arizona and 34 other states require energy-efficiency investments to be cost-effective.
- » What does it mean to be cost-effective?
 - Net present value of benefits outweighs net present value of costs.



Overview of Cost-Effectiveness Analysis

- » The elements included in an analysis depend on the test selected and judgment on the part of regulators and/or the utility or agency overseeing the analysis.
- » Several potential elements:

Benefits

- Avoided energy and capacity costs
- Savings on equipment or labor purchases (negative “costs”)
- Bill reductions
- Intangibles / Non-market goods
- Externalities and “Non-Energy Benefits” (e.g., avoided environmental impacts, improved comfort, job creation) may be accounted for in an “adder” or estimated in detail.

Costs

- Purchases of equipment, labor
- Administrative costs
- Increased purchases of energy
- Increases in other costs (e.g., O&M, water)
- Lost revenues

Overview of Cost-Effectiveness Analysis

- » Results reported in dollars (NPV), or as a ratio.
 - Net Benefits > \$0 mean the program is cost-effective.
 - Benefit / Cost ratio > 1 means the program is cost-effective.
 - Levelized cost (for PACT, TRC, or SCT):
 - \$/kWh or \$/MMBtu saved; \$/kW reduced
 - Easy to relate to the cost of energy

Basic approaches for calculating and presenting results of cost-effectiveness tests

Net Benefits (Difference)	Net Benefits _a (dollars)	=	NPV Σ benefits _a (dollars) - NPV Σ costs _a (dollars)
Benefit-Cost Ratio	Benefit-Cost Ratio _a	=	$\frac{\text{NPV } \Sigma \text{ benefits}_a \text{ (dollars)}}{\text{NPV } \Sigma \text{ costs}_a \text{ (dollars)}}$

Source: National Action Plan for Energy Efficiency (2008). Understanding Cost-Effectiveness of Energy Efficiency Programs: Best Practices, Technical Methods, and Emerging Issues for Policy-Makers. Energy and Environmental Economics, Inc. and Regulatory Assistance Project. California Standard Practice Manual (2001).

Overview of Cost-Effectiveness Analysis

» Five tests have been used since the 1980s as the main tools for screening DSM investments.

- Societal Cost Test (SCT)
- Total Resource Cost Test (TRC)
- Program Administrator Cost Test (PACT)
 - Also referred to as Utility Cost Test (UCT)
- Participant Cost Test (PCT)
- Ratepayer Impact Measurement Cost Test (RIM)

Societal Cost Test (SCT)

Asks: Is society better off as a whole?

Compares: Society's costs of energy-efficiency to resource savings, including non-cash costs and benefits.

May use a different discount rate

NPV \$

Benefits of DSM

Externalities

- Non-market benefits to society, or benefits that extend beyond a utility's customers.
- Primarily environmental improvements, such as better air/water quality, water savings, improved health, etc.
- Difficult to quantify.

Avoided Cost of Demand (kW - Generation, T&D)

Avoided Cost of Energy (kWh - Fuel and O&M)

Costs of DSM

Program Costs

Participant Costs

Total Resource Cost (TRC) Test

Asks: Will the total costs of energy in the utility service territory decrease?

Compares: Program administrator AND customer costs to the utility resource savings.

Transfers between utility and customer cancel out (incentives and bill savings/lost revenue).

NPV \$

Benefits of DSM

<i>Tax Credits</i>
<i>Avoided Cost of Demand (kW - Generation, T&D)</i>
<i>Avoided Cost of Energy (kWh - Fuel and O&M)</i>

Costs of DSM

<i>Program Costs</i>
<i>Participant Costs</i>

Utility Cost Test/Program Administrator Cost Test (UCT/PACT)

Asks: Are the utility's revenue requirements raised or lowered?

Compares: Costs of procuring efficiency resources (program administrator costs) to cost of procuring supply-side resources.

NPV \$

Benefits of DSM

Avoided Cost of Demand (kW - Generation, T&D)

Avoided Cost of Energy (kWh - Fuel and O&M)

Costs of DSM

Program Costs

Incentives Paid

Rate Impact Measure (RIM) Test

Asks: Will the utility rates increase?

Compares: Administrator costs and bill reductions to supply-side costs.

Does not consider that long-term costs of not making that EE investment (i.e. meeting that same demand with conventional generation) may be higher.

NPV \$

Benefits of DSM

Avoided Cost of Demand (kW - Generation, T&D)

Avoided Cost of Energy (kWh - Fuel and O&M)

Costs of DSM

Program Costs

Incentives Paid

Lost Revenue

Participant Cost Test (PCT)

Asks: Will the participants benefit over the measure life?

Compares: Costs and benefits for the customer installing the measure.

Indicates desirability of program to potential participants, so useful in program design.

NPV \$

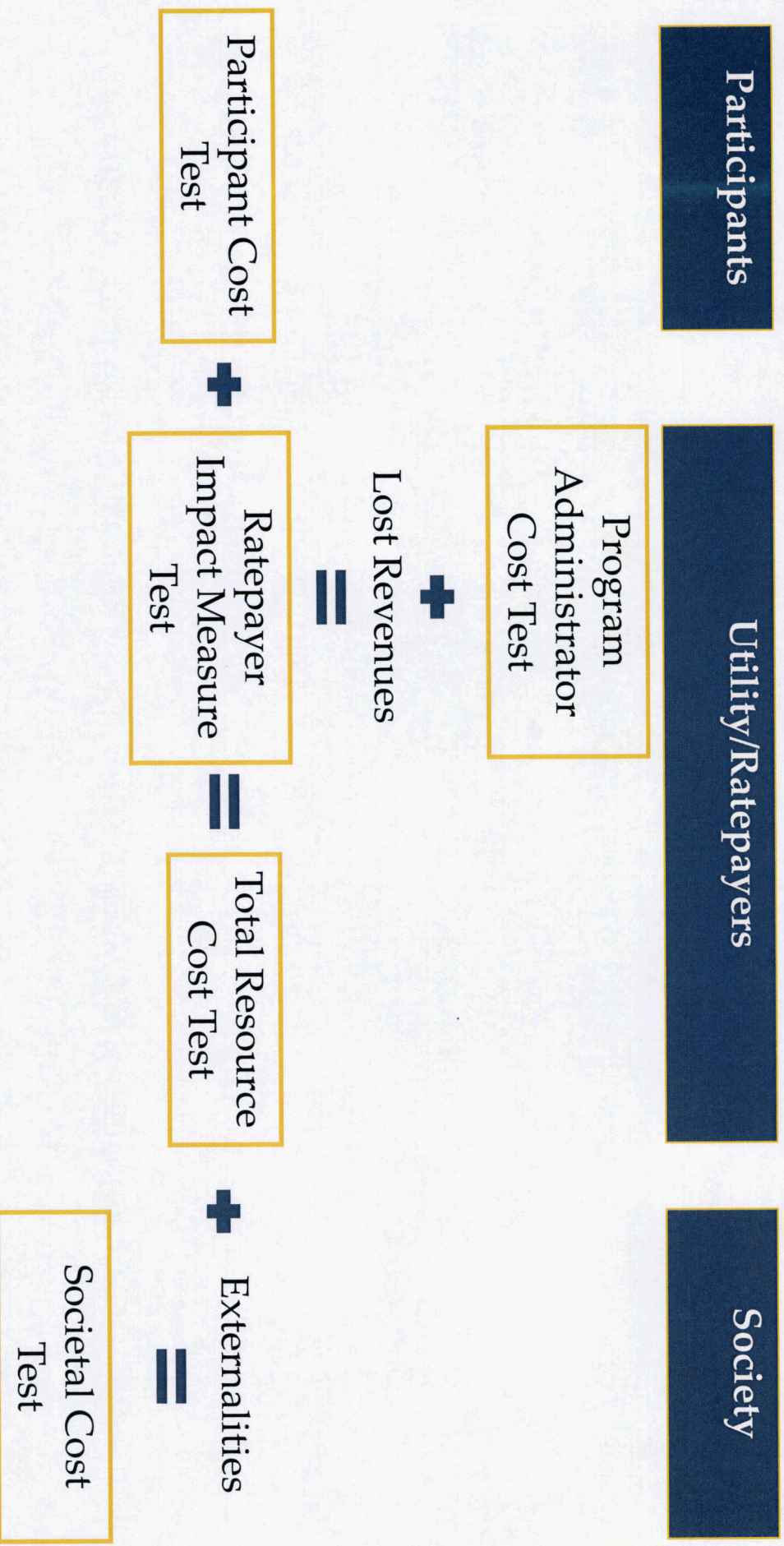
Benefits of DSM

<i>Tax Credits</i>
<i>Incentives Received (rebates)</i>
<i>Participant Bill Savings (electric, O&M, fuel, water)</i>

Costs of DSM

<i>Participant Costs (i.e., Equipment, Installation, O&M over baseline)</i>
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Cost-Effectiveness Test Relationships



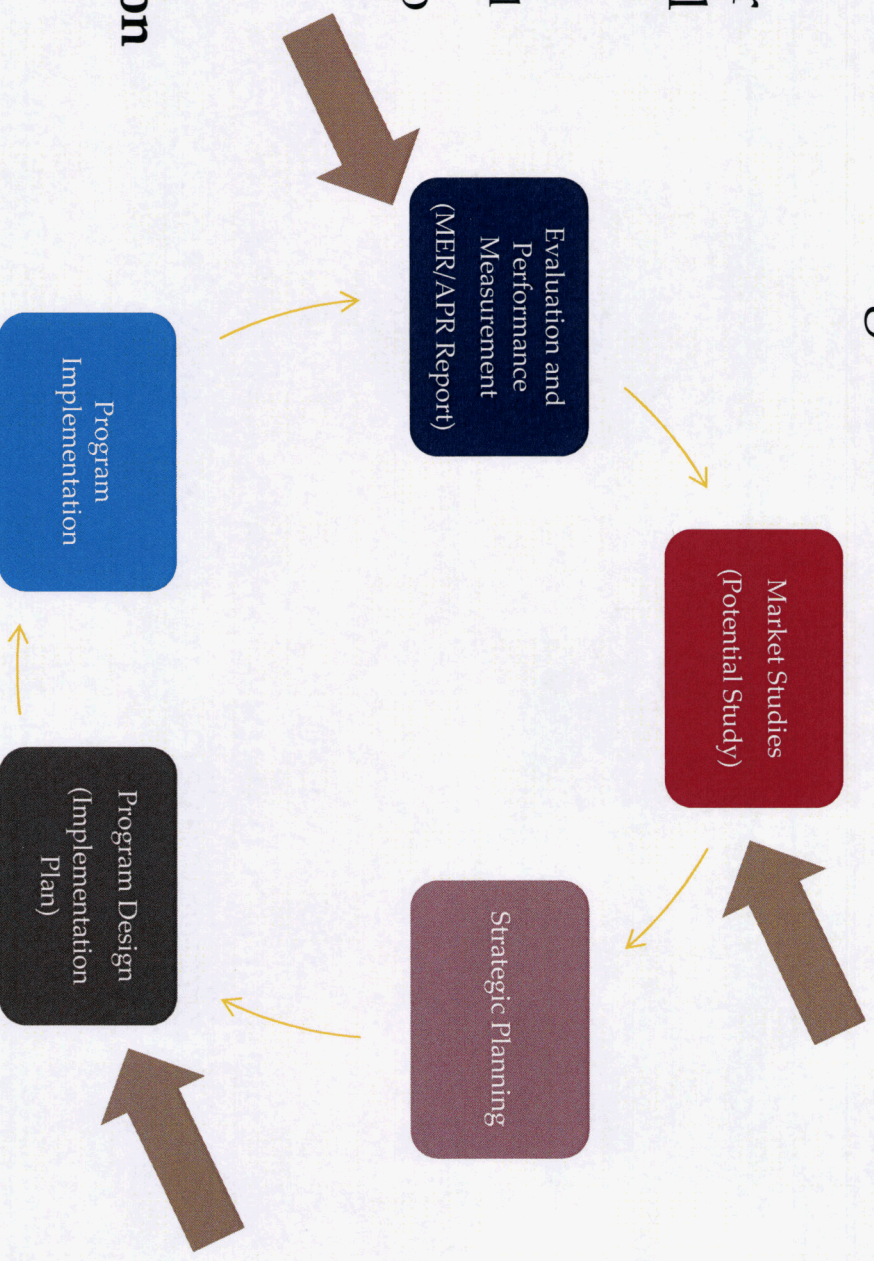
Cost Effectiveness Test Inputs

- » Measure Specific Inputs
 - Life of Measures (How long the measure lasts)
 - Energy and Demand Savings (Baseline vs. EE technology)
 - Incremental Cost of Measures (Retrofit vs. New vs. Replacement)
 - Other Benefits
- » Program Specific Inputs
 - NTG (Free-riders, Free-drivers)
 - Allocation of Program Costs
- » Economic/Utility Specific Inputs
 - Avoided Costs (Generation, T&D, Fuel and O&M)
 - Discount Rate (T-bills, WACC)

Overview of Cost-Effectiveness Analysis

When is cost-effectiveness testing used?

- » In **market studies** for preliminary and final screening
 - distinguishes technical and economic potential
- » In **program design** to incorporate detail characteristics and costs
- » In **program evaluation** to measure results



Which Test is Most Appropriate?

- » Selection of test reflects intended scope, and overall public policy goals driving the analysis. Societal Cost Test is currently used as the primary test in AZ.
- » Tests with narrower scopes (PCT, RIM, PACT) are helpful during program design. However, they are generally considered too limited for use as the “primary” tools for evaluating cost-effectiveness.

SCT

TRC

PCT

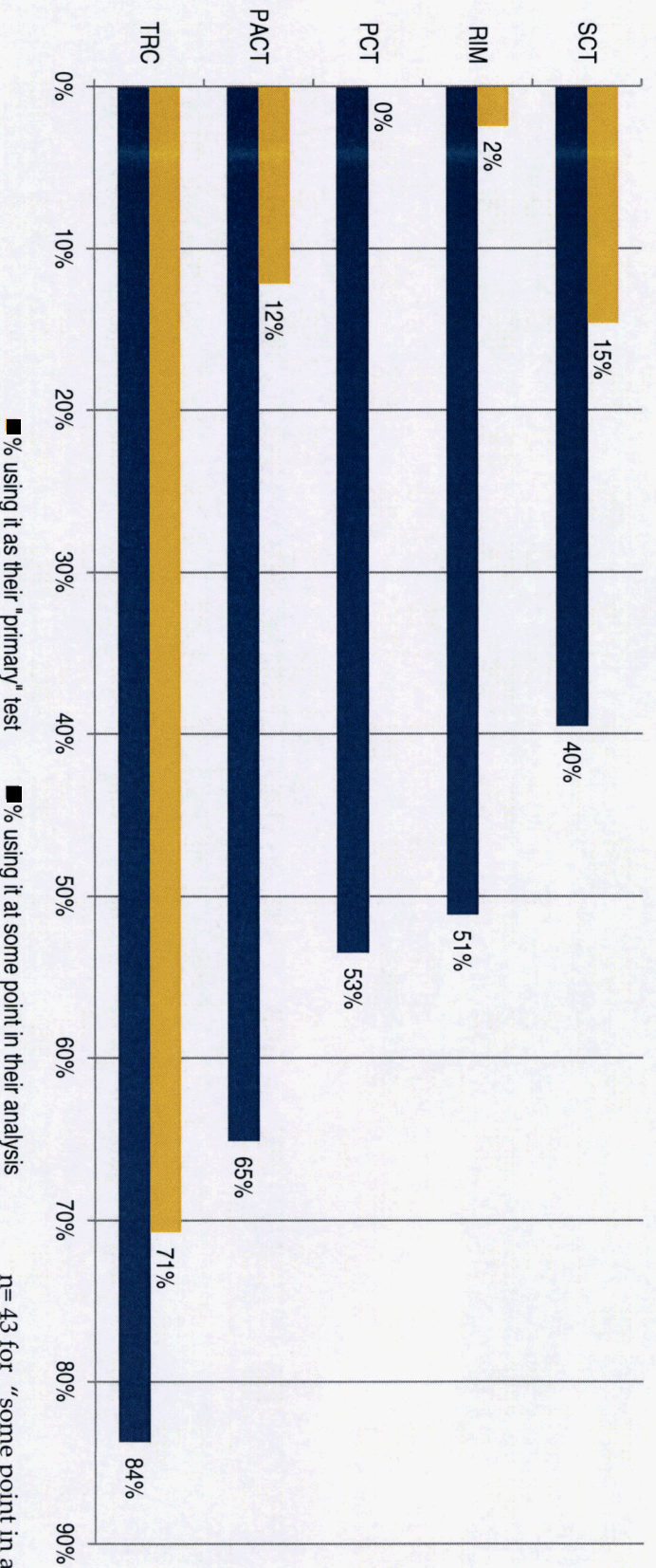
PACT

RIM

How are Other States Using the Tests?

- » TRC test is used most frequently, both for general screening purposes, and for use as the “primary” test for decision-making.

Percentage of states using each test



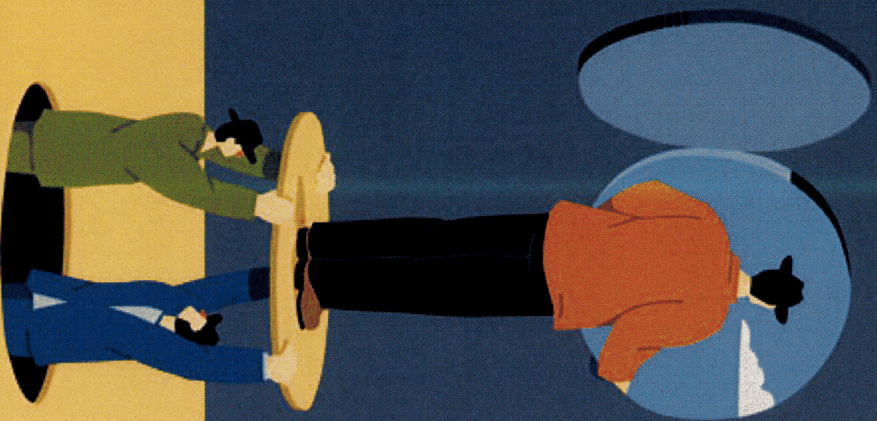
Source: Kushler M., et al. 2012. A National Survey of State Policies and Practices for the Evaluation of Ratepayer-Funded Energy Efficiency Programs. ACEEE.

n=43 for "some point in analysis;
n=41 for "primary test"

Conclusions

- » A variety of cost-effectiveness tests are available. Each looks at cost-effectiveness from a different perspective.
- » Selection of test, and decisions about test inputs should reflect public policy goals.
- » Common practice nationally is to use TRC/SCT applied at the program and/or portfolio level.
- » It is recognized in many jurisdictions that EE is often the least cost resource, and equitable CE analyses are needed to assess this resource as compared to other resource options.

Key CONTACTS



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**WESTERN RESOURCE
ADVOCATES**

**ENERGY EFFICIENCY WORKSHOP
MARCH 18, 2014: COST-
EFFECTIVENESS**

**Energy Efficiency and Resource Planning
Workshops**

Arizona Corporation Commission

(Docket Nos. RE-00000C-09-0427 & E-00000XX-13-0214)

David Berry

TOPICS COVERED IN THIS PRESENTATION

- Several key inputs in cost benefit analysis
 - **The discount rate**
 - **Two traps to avoid in cost benefit analysis**
- Overview of cost effectiveness tests
 - **Pros and cons**
 - **Tests commissions actually use**
- List of useful references

DISCOUNTING IN COST EFFECTIVENESS ANALYSES

- Typically, energy efficiency measures last several years (maybe as long as 30+ years)
 - The costs are often incurred up-front while the benefits occur over the lives of the measures
- Costs and benefits are compared by calculating their present values using a discount rate
- The **discount factor** translates the discount rate & time period into a present value.
 - For example, \$1,000 of benefits occurring in year 10 discounted at a rate of 8.3% translates into a present value of **\$451**. The discount factor for 10 years and this interest rate is **0.451**
 - \$1,000 of benefits occurring in year 30 (for a long-lasting measure) discounted at a rate of 8.3% translates into a present value of **\$91**, the discount factor is **0.091**.
 - Benefits from measures with long lives are largely ignored after a few years.

OF CAPITAL SHOULD NOT BE USED

- Under current energy efficiency program practices, utilities are not investing their capital in energy efficiency
- The public is paying for efficiency by foregoing current consumption to obtain long run benefits.



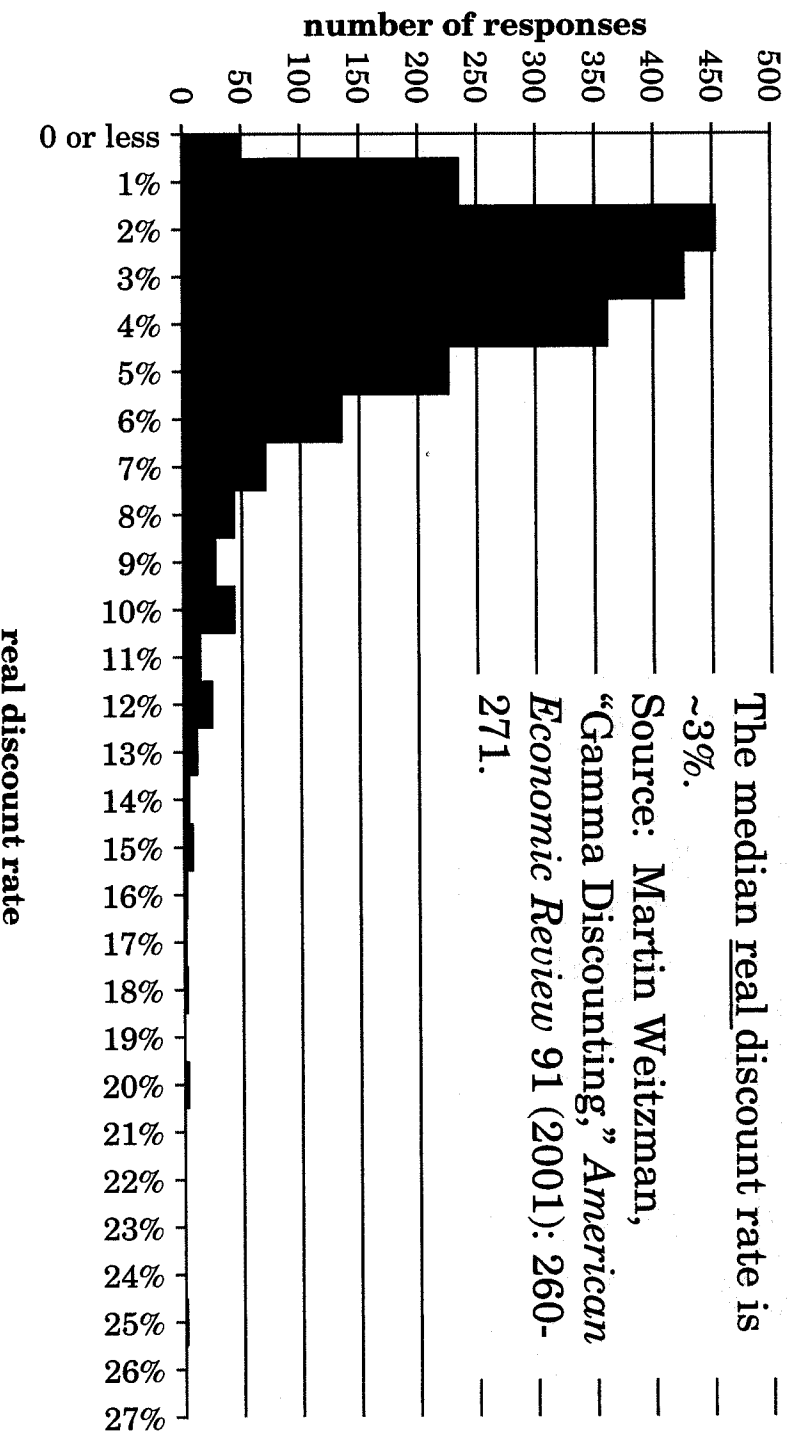
What discount rate should be used? Four respectable choices - you could use any of them

1. **Consumption rate of interest:**

- Assumes all costs raised from deferring consumption
- Use recent (nominal) Treasury Bond rates to help measure compensation for delaying consumption
 - 10 year bond = 2.74%, 20 year bond = 3.40%, 30 year bond = 3.68%
 - Federal Reserve December 2013 long run inflation forecast = 2%
- Adjust for tax impact ~ 25% to 30%
 - Real, after-tax consumption rate of interest estimated by Moore et al. using historical data is about **1.5%** using long term inflation trends
 - Using current data, about **1%**
- What about a risk premium for energy efficiency programs?
 - Not really needed: energy efficiency investments are not especially risky
 - The Commission and the utilities review plans and monitor and evaluate performance regularly so that poorly performing programs are modified or not implemented

2. USE THE CENTRAL TENDENCY OF ESTIMATES MADE BY 2160 ECONOMISTS

Economists' Estimates of Real Discount Rates for Evaluating Environmental Projects Over a Long Time Horizon (n = 2,160)



OR USE THE FOLLOWING APPROACHES

3. Optimal growth rate method

- Moore et al. recommend a real discount rate of ~3.3% based on historical, long run economic growth rate of ~2.3% per year and a real rate of time preference of ~1% per year
 - Assumes efficiency investments come out of current consumption (reasonable given the small monthly charge for efficiency programs)

4. Declining discount rates

- Takes into account uncertainty about the discount rate or about future economic conditions
- Weitzman recommends: a real discount rate of 4% in years 1-5, 3% for years 6 to 25, & 2% for years

26-75.

TWO COST-BENEFIT ANALYSIS TRAPS TO AVOID

Sunk cost trap

- The only costs that can be controlled are future costs – sunk costs cannot be undone.
- Utility fixed costs are sunk costs
- Decisions and government policies made on the basis of sunk costs constrain or distort economic decisions going forward.
 - Such decisions can lock in old technology and discourage innovation

Static analysis trap

- Do not assume the world stays the same
- Several factors increase achievable savings:
 - **Learning** (e.g., about roles of partnerships, trust, empowerment, social networks, & personal assistance)
 - Widening range of opportunities for efficiency
 - Cost changes and technology improvements

OVERVIEW OF TESTS FOR EFFICIENCY PROGRAMS

("+" INDICATES BENEFITS, "-" INDICATES COST)

Test	Participant	RIM	TRC	Societal	PACT (UCT)
Measured from perspective of:	Participant	Utility rates	Society (including or excluding externalities)		Utility revenue requirement
Avoided or deferred utility energy, capacity, T &D, and ancillary services costs		+	+	+	+
Other benefits	health			environmental & health	
Ancillary benefits (e.g., water svgs)	+		+	+	
Energy bill reductions	+				
Incremental measure costs: customer portion	-		-	-	
Incremental measure costs: financial incentive payments		-	-	-	-
Program administrative costs		-	-	-	-
Utility lost revenues		-			

THE SOCIETAL, TOTAL RESOURCE, & PROGRAM ADMINISTRATOR COST TESTS ARE ALL USEFUL: THE OTHERS SHOULD NOT BE USED

Test	Pros	Cons
Societal Cost	Comprehensive: includes all relevant costs and benefits; focus on all of AZ	Some benefits difficult to measure in \$ terms
Total Resource Cost	Similar to Societal Test	Omits some benefits
Program Administrator Cost	May be easiest to implement; consistent with utility resource analyses	Omits some costs and benefits; looks only at benefits & costs affecting utility, not society
Ratepayer Impact Measure	Estimates rate impacts on non-participants	Omits some costs and benefits; concerned with sunk costs; can reject measures which make society better off; many of today's non-participants will be tomorrow's participants
Participant	May help in designing financial incentives	Omits some important costs and benefits

WHAT TESTS HAVE COMMISSIONS USED?

- The Arizona Corporation Commission has used a total resource cost test or societal cost test for evaluating energy efficiency programs for about 25 years.
- ACEEE surveyed states to find out the primary test used in each state (n = 41 states)
 - 71% use the TRC test as the primary test
 - 15% use the SCT as the primary test
 - 12% use the PACT test as the primary test
 - 2% (1 state) uses the RIM test as the primary test
 - Many states use secondary tests to inform their decisions
- Example of a 2-tiered approach: use the TRC test or SCT as the primary test applied to each program and use the PACT as a secondary test on the package of all programs passing the primary test

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